REMARKS

Examiner Brophy is thanked for her examination of the subject Patent Application. The Specification and Claims have been carefully reviewed with respect to the cited prior art, the Claim has been amended and is considered to be in condition for Allowance.

DETAILED ACTION

Claim Rejections - 35 USC § 103

Reconsideration of the rejection of Claim 34 35 U.S.C. 103(a) as being unpatentable over Lin et al (5,851,881) in view of Hunter et al (4,631,803) is respectfully requested based on the following arguments.

The Examiner writes:

> Lin et al teach a flash memory comprising a substrate 10;
> a first gate oxide layer 30 atop the substrate 10;
> a floating gate 32 atop the gate oxide layer 30;
> a trench 71 formed through the floating gate 32 and gate oxide 30 layers into the substrate 10 wherein the vertical surfaces of the floating gate 32, the gate oxide layer 30 and the substrate 10 form interior trench walls,
> a second gate oxide layer 41; and
> a control gate 44 atop the second gate oxide 41.
> See Fig. 1 G and accompanying text.
>
> However, Lin et al do not teach that there are two conformal layers lining the interior trench walls.
> Hunter et al teach a STI structure wherein there are two conformal layers lining the inside walls of the trench and wherein a first conformal lining 38 comprises oxide having a thickness between about 200 to 450 Angstroms (col. 3, lines 40-42) and a second conformal lining 40 comprises nitride having a thickness between about 300 to a 600 Angstroms (col. 3, lines 45-48). See Fig. 2 and accompanying text.
>
> It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the structure taught by Lin et al by forming two conformal layers lining the trench in order to reduce the formation of the vertical 'bird's beak structure in the trench (see Hunter et al., col. 3, lines 21-24).

The Applicants reply:

The cited prior art Lin t al. (1) (5,851,881) is owned by the Taiwan Semiconductor Manufacturing Company, the same company that owns the instant application and its parent issue Lin et al (2) (6,358,796).

The instant application is for a structure formed by the method, as claimed in the parent application, for fabricating an isolation oxide without forming the detractive "bird's beak" also known as the "smiling" effect, .

Attached is an illustration including the figures of Lin et al. (1) and those of the instant application (2) for ease in viewing and which facilitates showing the contrast. Lin et al. (1) provides an oxide isolation in a trench in two steps. First, a large opening is made in a completed floating gate structure 41, 42 and 43 down to the substrate level (Fig. 1e). Spacers 47 are then formed on the walls of the floating gate structures and those spacers serve as a mask for forming the second smaller opening 71 into the substrate10, (Fig. 1f). Isolation oxide 70 is then formed in the substrate, (Fig. 1g) which does not rise to or above the floating gate 32.

By contrast, the instant structure (2) as shown in Fig. 4g is formed by one opening through a partially completed floating gate structure (210, 220) and into the substrate 200 and that opening has essentially one size. The isolation oxide (no reference numeral) is then formed prior to the completion of the floating gate structure. These isolation oxide and completion steps include "smiling" effect producing oxidation processes. But with the claimed method and the claimed resulting structure, the "smiling" effect is precluded.

However, this situation is not present in Lin et al. in view of Hunter. In the attached illustration (at "A") is a suggestion of how the dual conformal layers of Hunter would be used in Lin et al. in order to read on the instant claims. Two conformal layers are applied to the substrate and the spacers but not directly on the polysilicon floating gate. It is unknown what "smiling" effect phenomenon has taken place already to the structure of Lin et al. (1) since the floating gate structure has been completed but with no such description. At this point in the process, perhaps the spacers 47 prevent the "smiling" effect phenomenon without the need of Hunters dual conformal linings.

Other combinations of Lin et al. and Hunter similarly fail to produce the claimed structure. In the prior response to Office Action dated 11/19/02, it was argued that Hunter's process sequence did not produce the claimed structure.

The issued parent (2) claims a method of forming a flash memory cell that is devoid of the "smiling" effect while forming the isolation oxide in the presence of a floating gate. As such, a very specific structure results. In particular, as shown in the attached illustration (Fig. 4g at "B"), is the situation where the first and second conformal layers cover the edge of the floating gate thereby protecting the edge during subsequent oxide processing which could result in the "smiling" effect.

As such, the resulting structure as illustrated in Fig. 4g is claimed. In particular, claim 34 now focuses on the structure devoid of the "smiling" effect as a result of covering the edge of the floating gate with a dual conformal lining.

The conformal materials and thickness descriptions are returned to th ir

original dependent claims. The original dependent claims were incorrect with respect to their dependency and have been amended.

We have reviewed the related art references made of record and agree with the Examiner that none of these suggest the present claimed invention.

In light of the above arguments, it is suggested that the specification adequately describes the invention and that the Claims now clearly distinguish the invention from the prior art. All claims are therefore believed to be in condition for allowance.

Allowance of all claims is therefore respectfully requested.

It is request that should Examiner Brophy not find that the Claims are now Allowable that the Examiner call the undersigned attorney at 845-452-5863 to overcome any problems preventing allowance.

Respectfully submitted,

Stephen B Ackerman, Reg. No. 37,761

MARKED UP COPY OF CLAIMS

34. (CURRENTLY AMENDED) A split-gate flash memory cell structure having a ~~non-smiling~~ trench isolation devoid of the "smiling" effect comprising:

a substrate;

a first ~~gate~~ oxide layer atop said substrate serving as a gate oxide ;

a floating gate atop said first ~~gate~~ oxide layer;

a trench formed as a single continuous opening through said floating gate and said first ~~gate~~ oxide layers and into said substrate, wherein said ~~vertical~~ single continuous opened surfaces of said floating gate, said first ~~gate~~ oxide layer and said substrate form interior trench walls;

~~two conformal layers lining said interior trench walls, wherein a first conformal layer comprises oxide having a thickness between about 200 to 550 Å, and a second conformal layer comprises nitride having a thickness between about 100 to 300 Å;~~

a first conformal layer lining said interior trench walls, said first conformal layer being in contact with and extending over said continuous surfaces of said floating gate, said first oxide and said substrate;

a second conformal layer lining said interior trench walls, said second conformal layer being in contact with said first conformal layer and extending over said continuous surfaces of said floating gate, said first oxide and said substrate;

an isolation oxide filling said trench, wherein said isolation oxide is devoid of said "smiling" effect in proximity to said floating gate;

a second oxide layer atop said floating gate;

a third oxide layer atop said floating gate and said trench;

a control gate atop said ~~second gate~~ third oxide layer.

PLEASE REPRESENT CLAIM 35 AS AMENDED

35. (CURRENTLY AMENDED) The ~~method~~ split-gate flash memory cell structure of claim 34, wherein said first conformal lining comprises oxide have a thickness between about 200 to 500 Å.

PLEASE REPRESENT CLAIM 36 AS AMENDED

36. (CURRENTLY AMENDED) The ~~method~~ split-gate flash memory cell structure of claim 34, wherein said second conformal lining comprises nitride have a thickness between about 100 to 300 Å.

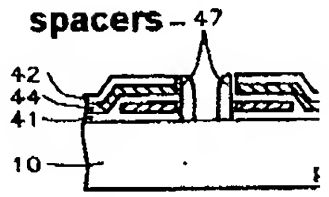


FIG. 1E

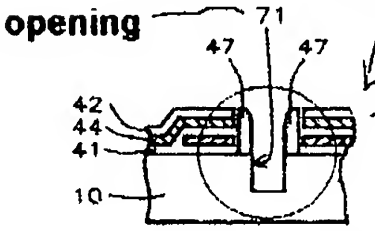


FIG. 1F

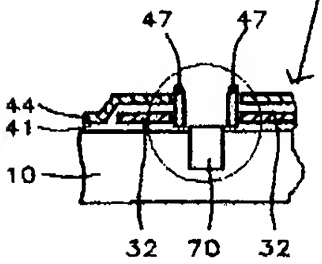
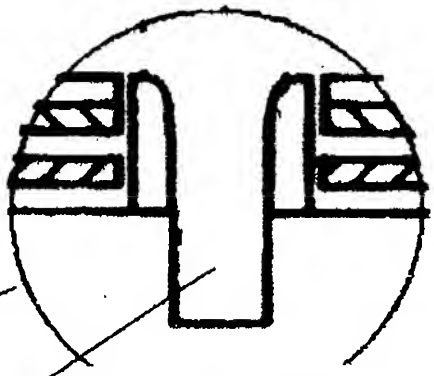


FIG. 1G



opening through substrate only

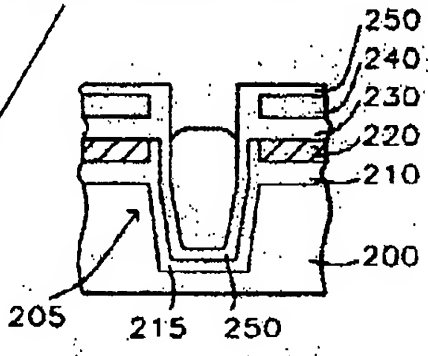
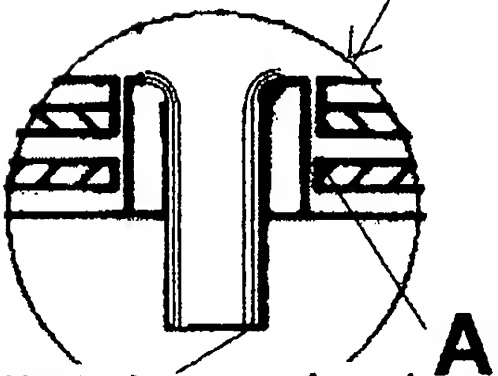


FIG. 4A



Hunter layers conformal to spacers and opening in substrate

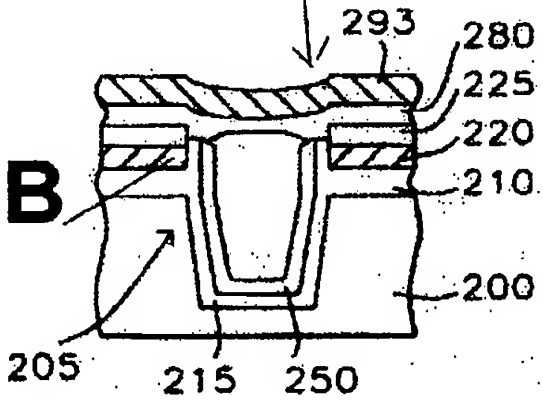


FIG. 4C